

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Robert Cochran and Jeffrey D. Ferreira-Pro
Assignee: Hewlett-Packard Development Company L.P.
Title: HIERARCHICAL STORAGE SYSTEM
Serial No.: 10/697,821 Filing Date: October 29, 2003
Examiner: Vy, Hung T Group Art Unit: 9535
Docket No.: 200311026-1 Confirmation No.: 9535

Irvine, California
September 18, 2006

COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER 37 CFR 1.131

We are applicants of the above-identified patent application and co-inventors of the subject matter described and claimed therein.

We were employed by Hewlett Packard Company, assignee of the above-identified patent application, at conception of the subject matter.

We believe we are original, first and joint inventors of subject matter (process, machine, manufacture, or composition of matter, or an improvement thereof) which is claimed and for which a patent is sought by way of the above-identified application.

Reference Matsunami et al. (U.S. Publication No. 2004/0193760), has been cited by the Examiner in rejecting Applicants' Claims 1-25 under 35 U.S.C. §102(e). The international filing date of Matsunami et al. is March 27, 2003. As described herein, the subject matter set forth in Claims 1-25 of the application was conceived in the United States

prior to March 27, 2003, and the applicants proceeded with due diligence from prior to the reference date to the filing of the application.

Prior to March 27, 2003, we conceived of the subject matter that is claimed in the above-identified patent application. Also prior to March 27, 2003 we filed an invention disclosure with Hewlett-Packard Company, assignee of the above-identified application. The application was prepared and filed in due course on October 29, 2003.

Attached hereto as exhibit I are five pages that comprise a copy of an official Invention Disclosure form that is used according to official Hewlett Packard procedures. Versions of Invention Disclosure were prepared and submitted on March 8, 2003 and March 11, 2003. The first two pages of the Invention Disclosure include reference material, title, inventors, and inventor contact information. Third and fifth pages describe technical aspects of an embodiment showing the claimed structure and techniques including the storage system comprising a storage array containing a plurality of storage devices of at least three types (including Fibre Channel (FC) and Serial ATA (S-ATA) and having a respective class hierarchy. The disclosure also shows a controller coupled to the storage device hierarchy and capable of executing an hierarchical storage management capability that selectively controls access to the hierarchy of storage devices corresponding to claims 1, 10, 18, and 25. Also shown are specifics of the priority of the hierarchy, as claimed in independent claims.

We declare that all acts in conception of the invention occurred in the United States.

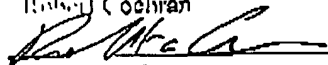
We declare that all statements made herein of my own knowledge are true, all statements made herein on information and belief are believed to be true, and all statements made herein are made with the knowledge that whoever, in any matter within the jurisdiction of the Patent and Trademark Office, knowingly and willfully falsifies, conceals, or covers up by any trick, scheme, or device a material fact, or makes any false, fictitious or fraudulent statements or representations, or makes or uses any false writing or document knowing the same to contain any false, fictitious or fraudulent statement or entry, shall be subject to the penalties including fine or imprisonment or both as set forth under 18 U.S.C. 1001, and that violations of this paragraph may jeopardize the validity of the application or this document, or

the validity or enforceability of any patent, trademark registration, or certificate resulting therefrom.

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Inventor's Signature:



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the validity or enforceability of any patent, trademark registration, or certificate resulting therefrom.

Full name of joint inventor: Robert Cochran

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Date: _____

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Full name of joint inventor:

Jeffrey M. Ferreira, Prof.

Inventor's Signature: _____

Date: _____

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I am patent attorney who prepared and filed the above-identified patent application.

"Reasonable diligence is all that is required of the attorney. Reasonable diligence is established if attorney worked reasonably hard on the application during the continuous critical period. If the attorney has a reasonable backlog of unrelated cases which he takes up in chronological order and carries out expeditiously, that is sufficient". Manual of Patent Examining Procedure (MPEP) §2138.06.

Hewlett-Packard Company has an extensive patent program, having tens of thousands of patents globally. Patent procedures include review and analysis of a large number of patent disclosures, leading to assignment of selected disclosures for patent preparation. Hewlett-Packard Company exercised reasonable diligence in review and analysis of the disclosures from submission of the disclosure on about March 11, 2003, to distribution of the disclosure assignment of June 30, 2003. The review and handling time from March 11, 2003,

to June 30, 2003, is believed to be reasonable and normal for a technology company of the size and technical complexity of Hewlett-Packard Company.

On June 30, 2003, I received a disclosure document and request for quote from Hewlett-Packard Company, assignee of the above-identified patent application. I diligently prepared the application and filed on October 30, 2003, including interaction with inventors, preparation of the patent draft, preparation of drawings, and review by in-house corporate counsel. The disclosure document was received by Hewlett-Packard Company on March 17, 2003 showing diligence from a time just prior to the reference date of March 27, 2003, to filing.

I have attached copies documents that establish invention conception prior to the reference date and diligence from a time prior to the reference date and filing. Evidentiary documents include:

Exhibit I is a copy of the disclosure document received by Hewlett-Packard Company on March 8, 2003, with supplemental addendum on March 8, 2003. Other dates that establish earlier conception are blocked off. The first two pages of the Invention Disclosure include reference material, title, inventors, and inventor contact information. Third and fifth pages describe technical aspects of an embodiment showing the claimed structure and techniques including the storage system comprising a storage array containing a plurality of storage devices of at least three types (including Fibre Channel (FC) and Serial ATA (S-ATA) and having a respective class hierarchy. The disclosure also shows a controller coupled to the storage device hierarchy and capable of executing an hierarchical storage management capability that selectively controls access to the hierarchy of storage devices corresponding to claims 1, 10, 18, and 25. Also shown are specifics of the priority of the hierarchy, as claimed in independent claims.

Exhibit II are nine pages of an official document for usage in Hewlett-Packard's Disclose 4.5 – HP Invention Disclosure System. The document includes invention disclosure material on the first two pages, inventor information and other administrative information on third and fourth pages, some of which is blacked out for privacy purposes, and the final five pages are disclosure material that duplicates appendix I. The disclosure material shows

submission on March 11, 2003, showing invention prior to the date of the reference cited by the Examiner. The fourth page shows that the disclosure was received by the Hewlett-Packard legal department on March 17, 2003.

Exhibit III is an email dated June 30, 2003. In combination, exhibits II and III show diligence in review of the disclosure and determining whether to proceed on the application in the time from submission of the disclosure on March 11, 2003, to emailing the disclosure to outside counsel on June 30, 2003. The filing date of October 29, 2003 indicates diligence in working with inventors to prepare the application, and review by corporate counsel.

I declare that all statements made herein of my own knowledge are true, all statements made herein on information and belief are believed to be true, and all statements made herein are made with the knowledge that whoever, in any matter within the jurisdiction of the Patent and Trademark Office, knowingly and willfully falsifies, conceals, or covers up by any trick, scheme, or device a material fact, or makes any false, fictitious or fraudulent statements or representations, or makes or uses any false writing or document knowing the same to contain any false, fictitious or fraudulent statement or entry, shall be subject to the penalties including fine or imprisonment or both as set forth under 18 U.S.C. 1001, and that violations of this paragraph may jeopardize the validity of the application or this document, or the validity or enforceability of any patent, trademark registration, or certificate resulting therefrom.

Full name of attorney:	Ken J. Koestner	Date:	
Attorney's Signature:			
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Post Office Address:	18662 MacArthur Blvd, Ste. 400	Citizenship:	U.S.A.
	Irvine, CA 92612		

Exhibit IAHRS - ERS

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Rev. 1

External Reference Specification for:
AHRS - Array-based Hierarchal Rotational Storage
 [To Accompany the Patent Disclosure by the same name. Intended to supply sufficient data that someone skilled in the art could use the ERS to implement a working model.]

Thumbnail Sketch: Traditional disk arrays have only 2 types of hierarchical storage: (1) volatile solid state cache/shared-memory, and (2) non-volatile high-performance, high-priced (3.5 cent/MB; SCSI/FC disks rotational storage)

This patent describes a disk array conditional storage hierarchy, that is a hierarchically ordered level of low-cost (1-1.0 - 1.5 the price of PC disks), lower performance Serial ATA (SATA) drives which can be used for temporarily requested (but not necessarily stored) and/or for HBM-type low usage user data storage.

SATA drives external to the array use not now (not are SATA-only arrays), what is now is the hierarchical mixing of FC/SCSI and SATA drives within the same array with the drives empowered to offer some SATA storage for low access customer data in FC/SCSI-based HBM, and to retain some for internal short term and unpredictable storage needs that are not appropriate for cache/shared-memory or high performance storage (or for which there is no pre-allocated space). This concept is ideal to be used with several prior patent submissions:

- SBLMR - Safety Backup LUNs Mirror Resync (socket # 10011270)
- PLMVS - Primary Local Mirror Volume Shadow (socket # 10001350)
- SLM - Snapshot Locality Migration (not yet submitted)
- BWOP - Backup Window Overdraft Protection (not yet submitted)

in which extra storage space (without the constraints of LUN copy licenses, pre-assignment or pre-configuration) is unexpectedly and temporarily needed within a disk array (as opposed to having to consider the unconventional use of hot spare disks). Secondly, the patent entitled 'Backup Window Overdraft Protection' (BWOP) in which a customer (that does not have the need LUN copy or snapshot functionality or does not currently have a set up for Zero Downtime Backup) is able to exceed their backup window, thus losing the entire backup. AHRS empowers BWOP to salvage the endangered backup using temporary non-volatile storage of sufficient capacity. The AHRS concept would be a significant competitive differentiator and potential lock-out step.

Bob Cochran - HP Roseville, CA, NSS R&D Engineer/Scientist (Open 43)
 Jeff Ferreira-Pro - HP Roseville

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Revision History

Rev.1 1-08-03, 1-11-03

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High-Level Introduction

Traditional disk arrays have only 2 levels of hierarchical storage:

- (1) solid state cache/shared-memory, and
- (2) high-performance, high-priced (3-5 cents/MB) SCSI/FC disks (rotational storage).

This patent describes a disk array rotational storage hierarchy. That is, a hierarchically inferior level of low-price (~ 1/3 - 1/5 the price of FC disks), lower-performance Serial ATA (SATA) drives which can be used for temporary/unexpected (but critical) storage and/or for HSM-type low usage user data storage.

SATA drives external to the array are not new (nor are SATA-only arrays), what is new is the hierarchical mixing of FC/SCSI and SATA drives within the same array, with the firmware empowered to offer some SATA storage for low access customer data (as in FIM-based HSM) and to retain some for critical short term and unpredictable storage needs that are not appropriate for volatile cache/shared-memory or high price/performance non-volatile storage (or for which there is no pre-allocated space).

This concept is ideal to be used with several prior patent submissions in which extra storage space (without the constraints of LUN copy licenses, pre-assignment or pre-configuration) is unexpectedly and temporarily/critically needed within a disk array (as opposed to having to consider the unconventional use of hot spare disks). Specifically, the patent embodied Backup Window Overdrive Protection (BWOP) in which a customer (that does not have licensed LUN copy or snapshot functionality, or does not currently have it set up for Zero Downtime Backup) is about to exceed their backup window, thus losing the entire backup. AHRB empowers BWOP to salvage the endangered backup using temporary non-volatile storage of sufficient capacity.

The AHRB concept would be a significant competitive differentiator and potential lock-out spec. Customers attracted to this feature would be in the mid and high-end range. This feature could result in solution configurations involving significant product/service drag to several parts of HP.

NOTE: If this concept were an enabler for just a single related patent, I would have been tempted to combine the two. However, the fact that it equally enables at least 4 other patents, suggests that it should not become entangled/identified with any one of them.

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What's Not New – (Prior Art)

- FC Disk arrays
- SATA Disk Drives
- Host SW controlled HSM (via external components)
- Intra-array LUN replication (e.g. snapshots and full copies)
- Inter-array LUN replication
- AutoRAID, disk array FW which moves data between RAID-1 and RAID-5 disk groups, depending on usage patterns (still all high-cost FC disks)
- Auto-LUN, host SW which moves files between RAID-1 and RAID-5 disk groups (and 10k rpm and 15k rpm), depending on usage patterns (still all high-cost FC disks)

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What "is" new - The Proposed Improvements

Firmware-based Hierarchical Storage Management (HSM) within a disk array utilizing both FC and SATA disk drives would be new. In this context, array FVV could save the SATA storage as uncommitted/unstructured and only use it for:

- Low Usage files (tolerant of lower performance)
- Temporary (but critical), uncommitted, non-volatile storage that may or may not be pre-allocated into specific LUNs:
 - SBLMR - Safer Bitmap LUN Mirror Resync [10011270]
 - PLMVS - Primary Local Mirror Volume Shadow [100201390]
 - SLM - Snapshot Liability Mitigation (not yet submitted)
 - BWOP - Backup Window Overdraft Protection (not yet submitted)
 - etc.
- intra-array LUN snapshots
- intra-array full LUN copies
- inter-array LUN copies

This concept is ideal to be used with several prior patent submissions:

- SBLMR - Safer Bitmap LUN Mirror Resync [docket #10011270]
- PLMVS - Primary Local Mirror Volume Shadow [docket #100201390]
- SLM - Snapshot Liability Mitigation (not yet submitted)
- BWOP - Backup Window Overdraft Protection (not yet submitted)
- etc.

in which extra storage space (without the constraints of LUN copy licenses, pre-assignment or pre-configuration) is unexpectedly and temporarily/critically needed within a disk array.

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EXHIBIT II**Invent**
Disclosure No. 200311026
 Invention Disclosure - DBI Document No. 8QSP

 PD No.
 200311026

 Date Received
 3/17/03

 Collection
 ESGN/SS

The information contained in this document is HP CONFIDENTIAL and may not be disclosed to others without prior authorization. Submit this disclosure to the HP Legal Department as soon as possible. No patent protection is possible until a patent application is authorized, prepared, and submitted to the Government.

**General Information**
Title AHRS - Array-based Hierarchal Rotational Storage

Abstract Traditional disk arrays have only 2 levels of hierarchical storage: (1) volatile solid state cache/shared-memory, and (2) non-volatile high-performance, high-priced (3-6 cents/MB) SCSI/FC disks (rotational storage).

This patent describes a disk array rotational storage hierarchy. That is, a hierarchically inferior level of low-price (~ 1/3 - 1/5 the price of FC disks), lower-performance Serial ATA (SATA) drives which can be used for temporary/unexpected (but critical) storage and/or for HSM-type low usage user data storage.

SATA drives external to the array are not new (nor are SATA-only arrays), what is new is the hierarchical mixing of FC/SCSI and SATA drives within the same array, with the firmware empowered to offer some SATA storage for low access customer data (as in FVM-based HSM) and to retain some for critical short term and unpredictable storage needs that are not appropriate for cache/shared-memory or high price/performance storage (or for which there is no pre-allocated space). This concept is ideal to be used with several prior patent submissions:

- SBLMR - Sector Bitmap LUN Mirror Resync[docket #10011270]
- PLMVS - Primary Local Mirror Volume Shadow [docket #100201380]
- SLM - Snapshot Liability Mitigation (not yet submitted)
- BWOP - Backup Window Overdraft Protection (not yet submitted)

In which extra storage space (without the constraints of LUN copy licenses, pre-assignment or pre-configuration) is unexpectedly and temporarily/critically needed within a disk array (as opposed to having to consider the unconventional use of hot spare disks). Specifically, the patent entitled 'Backup Window Overdraft Protection' (BWOP) in which a customer (that does not have licensed LUN copy or snapshot functionality, or does not currently have it set up for Zero Downtime Backup) is about to exceed their backup window, thus losing the entire backup. AHRS empowers BWOP to salvage the endangered backup using temporary non-volatile storage of sufficient capacity. The AHRS concept would be a significant competitive differentiator and potential lock-out spec.

Projects EVA V5.0

Products EVA future
**Attachments**
Attachments AHRS931103.doc - 3/11/03 12:06PM - ERS (Uploaded by Bob Cochran)
**Description of Invention**
Problems Solved See the attached ERS. Solves the problem of a disk array not having any non-

file:

3/23/2003

Disclose 4.5 - IIP Invention Disclosure System

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volatile, uncommitted, unstructured storage for which the array firmware to solve temporary but critical issues.

Prior Solutions See the attached ERS. Prior arrays have only (relatively) expensive FC disk drives for non-volatile storage.

Not New:

- FC Disk arrays
- SATA Disk Drives
- Host SW controlled HSM (via external components)
- Intra-array LUN replication (e.g. snapshots and full copies)
- Inter-array LUN replication
- AutoRAID, disk array F/W which moves data between RAID-1 and RAID-5 disk groups, depending on usage patterns (still all high-cost FC disks)
- Auto-LUN, host SW which moves files between RAID-1 and RAID-5 disk groups (and 10k rpm and 15k rpm), depending on usage patterns (still all high-cost FC disks)

Description See the attached ERS.

Firmware-based Hierarchical Storage Management (HSM) within a disk array utilizing both FC and SATA disk drives would be new. In this context, array F/W could save the SATA storage as uncommitted/unstructured and only use it for:

- Low Usage files (tolerant of lower performance)
- Temporary (but critical), uncommitted, non-volatile storage that may or may not be pre-allocated into specific LUNs.
- SBLMR - Sector Bitmap LUN Mirror Resync [docket #10011270]
- PLMVS - Primary Local Mirror Volume Shadow [docket #100201380]
- SLM - Snapshot Liability Mitigation (not yet submitted)
- BWOP - Backup Window Overdraft Protection (not yet submitted)
- etc.
- Intra-array LUN snapshots
- Intra-array full LUN copies
- Inter-array LUN copies

NOTE: If this concept were an enabler for just a single related patent, I would have been tempted to combine the two. However, the fact that it equally enables at least 4 other patents, suggests that it should not become entangled/identified with any one of them.

Advantages See the attached ERS.

This concept is ideal to be used with several prior patent submissions.

- SBLMR - Sector Bitmap LUN Mirror Resync [docket #10011270]
- PLMVS - Primary Local Mirror Volume Shadow [docket #100201380]
- SLM - Snapshot Liability Mitigation (not yet submitted)
- BWOP - Backup Window Overdraft Protection (not yet submitted)
- etc.

In which active storage space (without the constraints of LUN copy licenses, pre-assignment or pre-configuration) is unexpectedly and temporarily/critically needed within a disk array.



Invention History

Published No

Announced No

Disclosed No

Filed

3/25/2003

Disclosure 4.5 - IIP Invention Disclosure System

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Next Three Months No

Described Yes - ERS entitled AHRS-ERS.

Bulk No

Government Contract No

Related Disclosure Yes - 10011270 - SBLMR - Salar Bitmap LUN Mirror Resync[docket #10011270] - PLMVS - Primary Local Mirror Volume Shadow [docket #100301350] Both require temporary use of non-volatile disk array storage to solve a critical data integrity and/or replication issue. Also will be needed by: - SLM - Snapshot Liability Mitigation (not yet submitted) - BWOP - Backup Window Overrun Protection (not yet submitted)

Innovation Workshop No

Inventor Information

Inventors	Bob Cochran 00014302	Hewlett-Packard Company Worldwide (5265-6588)	Roseville United States [US]
	Jeffrey D Ferrelle-Pro 00355388	Hewlett-Packard Company Worldwide (5265-6675)	Roseville United States [US]

Witnesses

Witnesses	Michael Dwyer	Hewlett-Packard Company	5265-6588	Roseville Worldwide (5265-6588)
	Timothy Lyons	Hewlett-Packard Company	5265-6588	Roseville Worldwide (5265-6588)

Classification

Recommended Classification ESG/NSS: Online Storage Division: Enterprise Storage

Keywords EVA Internal HSM

Recommended Marlin Entity OSDH

Recommended Marlin Responsible attorney	Gren Ritz	Hewlett-Packard Company	0000-1031	FL Collina	Worldwide (0000-1031)
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Administrative Record

Date Submitted March 11, 2003 12:11PM

File

3/25/2003

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Legal Clerk [REDACTED] Hewlett-Packard
[REDACTED] Company 0000- FL Worldwide
1031 Collins (0000-1031) [REDACTED]

PD Number 200311028

Date Received by March 17, 2003
Legal

file:///c:/temp/ln2/disclosure_view.html

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AHRS - ERS

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Rev. 1

External Reference Specification for:**AHRS - Array-based Hierarchal Rotational Storage**

(To Accompany the Patent Disclosure by the same name. Intended to supply sufficient data that someone skilled in the art could use this ERS to implement a working model.)

Thumbnail Sketch: Traditional disk arrays have only 2 hierarchical storage: (1) volatile, fast, local cache (RAM), and (2) non-volatile, high-performance, high-price (2-5 cents/MB) SCSI/SAS disks (rotational storage).

This patent describes a disk array rotational storage hierarchy. That is, a hierarchy of tier or level of low-price (~1/3 - 1/5 the price of PC disks), lower-performance Serial ATA (SATA) drives which can be used for non-priority/unexpected (true archival) storage and/or for HBM-type low usage user data storage.

SATA drives external to the array are not new (nor are SATA-disk arrays), what is new is the hierarchical mixing of PC/SATA and SATA drives within the same array, with the hardware empowered to deliver same SATA storage for low access customer data jobs in P4-based HBM; and to retain some fast or fast short-term and unpredictable storage needs (they are not appropriate for cache/short-term or high price/performance storage for for which there is no direct access space). The concept is ideal to be used with non-eras, prior cache/short-term.

- **BLMF** - Backup Mirror Local Mirror/Backup (patent # 10011270)
- **PLMVS** - Primary Local Mirror Volume Shadow (patent # 10021280)
- **SLM** - Snapshot Liability Migration (not yet submitted)
- **BWCP** - Backup Window Overlap Prevention (not yet submitted)

In which extra storage space (without the constraints of LUN copy licenses, pre-configuration or pre-configuration) is unpredictably and temporarily/locally needed within a disk array (as opposed to having to consider the (un)availability of hot spare disks). Essentially, the patent titled Backup Window Overlap Prevention (BWOP) is, which a customer (that does not have licensed LUN copy or snapshot functionality, or does not currently have disk up for Zero Downtime Backup) is about to exceed their backup window, thus losing the entire backup. AHRS empowers BWOP to salvage the endangered backup using temporary non-volatile storage of sufficient capacity. The AHRS concept would be a significant improvement of backup and restore tool-out time.

Bob Cochran - HP Roseville, CA, NSS R&D Engineer/Scientist (Opus 43)
Jeff Ferreira-Pro - HP Roseville

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High-Level Introduction

Traditional disk arrays have only 2 levels of hierarchical storage:

- (1) solid state cache/shared-memory, and
- (2) high-performance, high-priced (3-5 cents/MB) SCSI/FC disks (rotational storage).

This patent describes a disk array rotational storage hierarchy. That is, a hierarchically inferior level of low-price (~ 1/3 - 1/5 the price of FC disks), lower-performance Serial ATA (SATA) drives which can be used for temporary/unexpected (but critical) storage and/or for HSM-type low usage user data storage.

SATA drives external to the array are not new (nor are SATA-only arrays). What is new is the hierarchical mixing of FC/SCSI and SATA drives within the same array, with the firmware empowered to offer some SATA storage for low access customer data (as in FV-based HSM) and to retain some for critical short term and unpredictable storage needs that are not appropriate for volatile cache/shared-memory or high price/performance non-volatile storage (or for which there is no pre-allocated space).

This concept is ideal to be used with several prior patent submissions in which extra storage space (without the constraints of LUN copy licenses, pre-assignment or pre-configuration) is unexpectedly and temporarily/critically needed within a disk array (as opposed to having to consider the unconventional use of hot spare disks). Specifically, the patent entitled 'Backup Window Overdrive Protection' (BWOP) in which a customer (that does not have licensed LUN copy or snapshot functionality, or does not currently have it set up for Zero Downtime Backup) is about to exceed their backup window, thus losing the entire backup. AHRs empowers BWOP to salvage the endangered backup using temporary non-volatile storage of sufficient capacity.

The AHRs concept would be a significant competitive differentiator and potential lock-out spec. Customers attracted to this feature would be in the mid and high-end range. This feature could result in solution configurations involving significant product/services drag to several parts of HP.

NOTE: If this concept were an enabler for just a single related patent, I would have been tempted to combine the two. However, the fact that it equally enables at least 4 other patents, suggests that it should not become entangled/identified with any one of them.

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What's Not New – (Prior Art)

- FC Disk arrays
- SATA Disk Drives
- Host SW controlled HSM (via external components)
- Intra-array LUN replication (e.g. snapshots and full copies)
- Inter-array LUN replication
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- Auto-LUN, host SW which moves files between RAID-1 and RAID-5 disk groups (and 10k rpm and 15k rpm), depending on usage patterns (still all high-cost FC disks)

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What "is" new - The Proposed Improvements

Firmware-based Hierarchical Storage Management (HSM) within a disk array utilizing both FC and SATA disk drives would be new. In this context, array FW could save the SATA storage as uncommitted/unstructured and only use it for:

- Low Usage files (tolerant of lower performance)
- Temporary (but critical), uncommitted, non-volatile storage that may or may not be pre-allocated into specific LUNs:
 - SBLMR - Safe Bitmap LUN Mirror Resync [10011270]
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- etc.

In which extra storage space (without the constraints of LUN copy licenses, pre-assignment or pre-configuration) is unexpectedly and temporarily/critically needed within a disk array.

HP-NSS R&D (Network Storage Solutions)

APPENDIX III

Page 1 of 1

Ken Koestner

From: "SCHULZE, TARA (HP-FtCollins,ex1)" <tara.schulze@hp.com>
To: <kkoestner@kbpatents.com>
Sent: Monday, June 30, 2003 1:34 PM
Attach: 200311026.pdf; Supplemental Procedures for new cases.pdf; RFQ 200311026.doc
Subject: RFQ for New HP case=200311026

Ken,

Grant Ritz requested that I forward the above referenced disclosure to you for drafting.

Please find attached:

- RFQ and letter of engagement
- Disclosure 200311026
- Supplemental procedures for new cases

Please confirm receipt of this transmission via e-mail reply.

Thank you.

9/15/2006